Sports Medicine and Health Science 2 (2020) 33–37

Contents lists available at ScienceDirect

Sports Medicine and Health Science

journal homepage: www.keaipublishing.com/en/journals/sports-medicine-and-health-science/

Original Research

Correlates of physical activity in fifth-grade students in Ho Chi Minh City, Vietnam

Quyen G. To [a,b,*], Danielle Gallegos [c], Dung V. Do [d], Hanh TM. Tran [e], Kien G. To [d], Lee Wharton [b], Stewart G. Trost [c]

[a] Appleton Institute, School of Health, Medical and Applied Sciences, Central Queensland University, Australia
[b] School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Australia
[c] School of Exercise and Nutrition Sciences, Institute for Health and Biomedical Innovation at QLD Centre for Children's Health Research, Queensland University of Technology, Brisbane, Australia
[d] Faculty of Public Health, University of Medicine and Pharmacy at Ho Chi Minh City, Viet Nam
[e] Nutrition Center, Ho Chi Minh City, Viet Nam

ARTICLE INFO

Keywords:
Exercise
Primary school
Psychosocial
Environmental
Parental support

ABSTRACT

Studies investigating correlates of physical activity (PA) using objective PA measurements among primary school-aged children are limited in Asia, particularly Vietnam. This study examined psychosocial and environmental factors associated with PA among fifth-grade students in eight primary schools in Ho Chi Minh city, Vietnam. Bivariate analyses showed that for every month increase in students' age, an increase of 66 steps/day ($p<0.05$) was found; boys had 1442 more steps/day than girls ($p<0.001$); and students from lower income households had 1169 steps/day less than those from higher income households ($p<0.01$). For every unit increase in self-efficacy, perceived social influences, intention to be physically active, and parental support for PA, an increase of 220, 200, 522, and 117 steps/day ($p<0.01$) was found respectively. In multivariable analysis, only intention and parental support for PA remained significant ($p<0.01$). About 21% of variation in daily steps was explained by demographic characteristics and an additional 13% by psychosocial influences. In conclusion, intention to be physically active and parental support are important factors and should be considered when designing PA interventions in school/community-based settings.

Introduction

Physical activity (PA) has multiple health-related benefits among children including cardiometabolic, skeletal, and mental health.[1,2] Despite the benefits, a majority of children/youth in high and lower middle-income countries (LMIC) do not meet the physical activity guideline of engaging in daily moderate-to-vigorous PA (MVPA) for ≥60 min/day.[3] In Vietnam, data from the Global School-based Student Health Survey, conducted between 2003 and 2007 by WHO, showed that 18.2% of adolescents aged 13–15 years were not active.[4] Although national data on children's PA are unavailable, only about 18% of children in urban areas of Ho Chi Minh City (HCMC) met the PA recommendation.[5] There was also evidence that PE programs in Vietnam did not provide students with sufficient time engaging in MVPA.[6]

Previous studies have shown that factors associated with PA in children ranged from intra-personal and inter-personal to the environmental level.[7] These factors included self-efficacy, intention to be physically active, perceived barriers, parental support, facility access, time spent outdoors, public transportation, traffic density/speed, and crime.[8–12] However, most studies were conducted in the U.S or other high-income countries and the extent to which the results can be generalised to Vietnamese children has not been investigated. As many LMIC are in economic and epidemiologic transition due to urbanization, modernization and mechanization resulting in a more sedentary lifestyle,[13] information about PA correlates among children in LMIC are urgently needed so that effective interventions that are culturally and contextually appropriate can be designed and implemented.

The purpose of this study was to identify factors associated with PA among fifth-grade students in HCMC, Vietnam. The study is significant given that understanding the cultural context in which PA occurs is important and there is a lack of research investigating PA correlates using objective PA measurements among primary school-aged children, not

* Corresponding author. Central Queensland University, Rockhampton, Australia.
E-mail address: q.to@cqu.edu.au (Q.G. To).

https://doi.org/10.1016/j.smhs.2020.02.002
Received 5 December 2019; Accepted 7 February 2020
Available online 14 February 2020
2666-3376/© 2020 Chengdu Sport University. Production and hosting by Elsevier B.V. on behalf of KeAi. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Table 1
Characteristics of participants.

	Subsample		Total sample	
	n	% or mean (*SE*)	*n*	% or mean (*SE*)
Age (months)	619	125.0 (2.3)	757	125.1 (2.1)
Height (cm)	617	139.8 (1.4)	754	140.0 (1.3)
Weight (kg)	617	38.6 (1.1)	754	38.9 (1.1)
BMI (kg/m^2)	617	19.6 (0.2)	754	19.6 (0.2)
Weight status	617		754	
Thin	13	1.9	16	2.1
Healthy	236	45.4	281	44.4
Overweight	190	28.5	235	29.3
Obese	178	24.2	222	24.2
Primary caregiver	543		635	
Father	72	15.4	89	16.6
Mother	419	76.2	489	75.5
Grandparent	38	5.7	43	5.7
Other	14	2.7	14	2.2
Survey respondent	537		628	
Father	134	25.9	160	26.7
Mother	381	69.5	443	68.9
Grandparent	12	2.1	14	2.4
Other	10	2.5	11	2.1
Respondent's age (years)	479	39.4 (0.4)	559	39.6 (0.4)
Respondent's education	540		632	
Below elementary school	27	6.8	30	6.6
Below middle school	75	18.5	85	18.8
Below high school	76	18.0	96	19.2
High school graduate	161	32.8	184	31.2
Undergraduate degree	167	20.3	199	20.7
Graduate degree/above	34	3.7	38	3.4
Monthly household income	495		578	
<4 million VND	74	19.7	82	20.3
4 - <10 million VND	173	43.4	202	42.1
10 - <20 million VND	130	21.2	158	22.8
20 - <30 million VND	58	7.0	68	6.8
≥30 million VND	60	8.7	68	8.0
#people in the house	533		623	
2–3 people	59	11.2	73	13.6
4–5 people	295	62.7	342	61.6
6–8 people	123	20.6	146	19.6
9 or more	56	5.5	62	5.2
#children in the house	531		622	
1 child	135	27.2	163	27.9
2 children	276	53.0	320	53.0
3 children	69	12.7	80	12.3
4 or more	51	7.1	59	6.8
Tutoring after school (yes)	323	56.2	376	55.1
Walk/bike to school (yes)	79	18.1	93	16.4

only in Vietnam, but also in Asia.

Methods

Study design and population

This cross-sectional study was conducted between January and September 2016 among fifth-grade students and their parents in primary schools in HCMC, Vietnam. Public primary schools in urban areas of HCMC with at least two fifth-grade classes were included in the sampling frame. The number of schools eligible for participating in the study was 304 schools. Schools were stratified into "nationally recognized schools" and "not nationally recognized schools" and then into low and high socio-economic status (SES). National recognition is awarded to schools meeting criteria set by the Ministry of Education and Training[14] including number of classes and students, dimension of classrooms and playground, and available infrastructure/equipment for teaching. National recognition was not based on academic outcomes. The classification for SES was based on the statistics report of HCMC.[15] Within each stratum, the number of schools was 3 (National Recognition - High SES), 21 (National Recognition – Low SES), 54 (Not National Recognition – High SES), and 226 (Not National Recognition – Low SES). A probability-proportional-to-size method based on the number of students at each school was used to randomly select eight schools with two schools selected from each stratum.

Three to five fifth-grade classes were randomly selected from within each school. All students in these classes were eligible. Written consent was obtained from parents. Written approvals from the schools and the HCMC Department of Education and Training were also obtained. Ethics approval was gained from Queensland University of Technology Human Research Ethics Committee (1500000549).

Table 2
Average scores of scales on psychosocial and environmental influences.

		Total		Girl		Boy	
	Maximum score	*n*	mean (*SE*)	*n*	mean (*SE*)	*n*	mean (*SE*)
Self-efficacy	16	618	9.0 (0.1)	310	9.1 (0.1)	308	9.0 (0.2)
Perceived social influences	8	616	4.6 (0.4)	308	4.7 (0.4)	308	4.4 (0.4)
PA beliefs	16	615	12.3 (0.1)	311	12.3 (0.1)	304	12.2 (0.1)
Parental support	25	524	10.6 (0.6)	279	9.8 (0.5)	245	11.3 (0.5)
Parental perceived safety	35	513	19.0 (0.2)	277	19.2 (0.4)	236	18.8 (0.7)

Measurement

Demographic and anthropometric variables

Gender was self-reported by students and age was calculated in months. Students' height and weight were measured using standard methods.[16] Body Mass Index (BMI) was calculated by weight(kg)/height(m)^2. Students were classified as overweight (z-score>1), obese (z-score>2), or underweight (z-score<−2) using the WHO Child Growth Standards.[17] Parent's completed a questionnaire measuring age, highest level of education, number of household residents, number of children in the house, household monthly income, and whether their child attended private tutoring classes.

Physical activity

Pedometers (Digiwalker SW200) were used to record daily steps. A seven-day protocol[18] was modified and used. Students recorded steps on reporting cards at the beginning and end of school, but only once in the morning during weekends. Parents received text messages to remind students to wear pedometers and record the step counts. After calculating the singe day ICC for step counts, the number of monitoring days needed to achieve a reliability of 0.75 was found via the Spearman-Brown prophecy formula to be four. Given the difference in PA between weekdays and weekends, students with ≥3 weekdays and one weekend day of daily step data were included in the analyses.

Psychosocial variables

Self-efficacy, perceived social influences, and PA beliefs were measured using modified scales.[19] The self-efficacy scale has 16 items asking i) whether students have support from parents/other adults or friends for PA; ii) whether students are confident to overcome barriers to PA; and iii) whether students have positive alternatives to PA. The perceived social influences scale has 8 items to assess influences of family and friends on PA. The PA beliefs scale has 16 items asking students about consequences of being physically active. Responses for each item were recorded using dichotomous yes/no format.

Intention to be physically active was measured by one question with five response options: "During my free time on most days: i) I am sure I will not be physically active; ii) I probably will not be physically active;

Table 3
Bivariate associations between daily steps and other variables.

	n	Coefficient (95% *CI*)	*p*
Demographic/anthropometric variables			
Student's age (months)	619	66 (1, 131)	0.045
Gender (male vs. female)	619	1442 (925, 1959)	<0.001
BMI	617	17 (−54, 90)	0.632
Parent's age (years)	479	−41 (−87, 3)	0.070
Parent's education (Below high school vs. high school/above)	540	−492 (−1129, 145)	0.130
Household monthly income (<20 million VND vs. 20 million/above)	495	−1169 (−1870, −468)	0.001
# of residents	533	7 (−119, 135)	0.904
# of children	531	146 (−135, 427)	0.308
Attend private tutoring vs. Not	450	58 (−661, 778)	0.873
Psychosocial variables			
Self-efficacy	618	220 (128, 313)	<0.001
Perceived Social Influences	616	200 (65, 335)	0.004
Beliefs	615	64 (−31, 160)	0.189
Intention	595	522 (244, 801)	<0.001
Parental support for PA	524	117 (61, 174)	<0.001
Environmental variables			
Walk/bike to school vs. Not	608	−7 (−817, 801)	0.985
Parental perceived safety	513	−11 (−74, 53)	0.732

Table 4
Multivariable associations between daily steps and psychosocial/environmental factors.

	Adjusted Coefficient (95% *CI*)	R^2
Model 1 ($N = 401$)		0.21
Student's age (months)	47 (−32, 124)	
Gender (male vs. female)	1350 (718, 1982)***	
Parent's age (years)	−56 (−105, −6)*	
Parent's education (Below high school vs. high school/above)	−507 (−1276, 262)	
Household monthly income (<20 million VND vs. 20 million/above)	−1156 (−1909, −402) **	
Model 2 ($N = 401$)		0.34
Student's age (months)	69 (−8, 147)	
Gender (male vs. female)	1136 (516, 1758)***	
Parent's age (years)	−49 (−97, −1)*	
Parent's education (Below high school vs. high school/above)	−213 (−978, 551)	
Household monthly income (<20 million VND vs. 20 million/above)	−1073 (−1808, −339) **	
Self-efficacy	64 (−64, 191)	
Perceived Social Influences	87 (−87, 261)	
Intention	491(141, 840)**	
Parental support for PA	110 (41, 178)**	

*$p<0.05$, **$p<0.01$, ***$p<0.001$.

iii) I may or may not be physically activity; iv) I probably will be physically active; andv) I am sure I will be physically active.[19]

Parental support for PA was measured using a five-item scale[20] asking parents during a typical week, how often an adult carer would in the household i)"encourage your child to do physical activity or play sports"; ii)"play outside with your child or do physical activity or sports with your child"; iii)"ride or provide transportation to a place your child can do physical activity or play sports"; iv)"watch your child participate in sport, physical activities, or outdoor games"; and v)"tell your child that sports or physical activity is good for their health". Responses for these items were "never", "<1 times/week", "1–2 times/week", "3–4 times/week", "5–6 times/week", or "daily".

Perceived environmental influences

A modified 12-item scale[21] was used for parents to report the perceived safety of the neighbourhood. Responses were "strongly agree", "agree", "disagree", and "strongly disagree".

Five questions were used to assess students' commuting to school.[22] These questions asked how and with whom the student went to school; where students will go directly after school; how and with whom students will go.

The psychometric properties of the five scales in Vietnamese children is reported elsewhere.[23] Briefly, they were translated into Vietnamese by the first author and back-translated into English by an independent Vietnamese researcher. Then, a native English speaker compared two versions. Disagreements were discussed and adjusted. Reviews from two Vietnamese experts were completed to ensure the questions are clear and culturally appropriate. After conducting cognitive interviews with fifth-grade students and parents, the Vietnamese scales were adjusted and finalised. Intra-class correlation coefficients (ICC) for the scales were fair to good ranging from 0.56 to 0.77. Cronbach's alphas were minimally acceptable ranging from 0.62 to 0.76.[24]

Statistical analysis

Epi-Data 3.0 was used to enter data from parent and student questionnaires. For self-efficacy, social influences, and beliefs, responses were assigned a score (yes = 1, no = 0). Responses to items 2, 6, 8, 10, and 11 of the beliefs scale were reverse scored. For the parental support for PA scale, a score of 0–5 was assigned respectively to a response of "Never" to "Daily". A score of 0–3 was assigned to a response of "Strongly agree" to "Strongly disagree" on the perceived neighbourhood safety scale; except for items 5, 9, 10, and 11 which were reverse scored. Data from those completing at least 75% of the items in each scale were used. Average scores were calculated and then multiplied with the number of items to get the total scores.

SAS v9.4 was used for data analysis. Weighted descriptive statistics were generated for each variable and were presented by gender with 95% confident intervals (CI). Generalised linear mixed models with a random effect for the schools to incorporate intra-cluster correlations were used to test associations between each independent variables and daily steps.[25] Individual variables with $p < 0.15$ were entered in multivariable analyses in blocks of i) demographic and anthropometric, ii) psychosocial, and iii) environmental factors. Only cases with complete data for the variables were included in the multivariable analysis. The variation in the step counts explained by demographic/anthropometric variables and by all independent variables were calculated based on the likelihood ratio method.[26] All p-values were two-sided and considered significant if < 0.05.

Results

Characteristics of the sample

Among 1235 invitations sent out, 757 (61.3%) agreed to participate. However, only 619 (81.8%) who met the inclusion criterion of with ≥3 weekdays and one weekend day of pedometer data were included in the analysis. A description of participants in the whole sample and subsample is presented in Table 1. The characteristics of participants were quite similar between the two.

Table 2 shows that average scores for the psychosocial and environmental influences. Students' scores on the PA beliefs scale (77% of the maximum score) were proportionally higher than those obtained on to the self-efficacy and perceived social influences scales (~57% of the maximum score). The scores for all scales were similar for boys and girls.

Bivariate analysis

Bivariate analyses show that students' age, gender, household income, self-efficacy, perceived social influences, intention to be physically active, and parental support for PA were significantly associated with daily step counts (Table 3). For every month increase in students' age, an

increase of 66 steps/day ($p < 0.05$) was found; boys had about 1442 more steps/day than girls ($p < 0.001$); and students from households with lower incomes had 1169 steps/day less than those from higher income households ($p < 0.01$). For every point increase in self-efficacy, perceived social influences, intention to be physically active, and parental support for PA, an increase of 220 steps/day ($p < 0.001$), 200 steps/day ($p < 0.01$), 522 steps/day ($p < 0.001$), and 117 steps/day ($p < 0.001$) was found respectively. PA beliefs, parental perceived safety and walking/biking to school were not associated with daily steps.

Multivariable hierarchical regression

Table 4 shows results from multivariable analyses. Model 1 which included only demographic variables explained 21% of the variation in daily steps. Of the five variables entered, gender, parental age and household monthly income were significantly associated with daily steps. Model 2 which included the demographic and psychosocial variables explained 34% of the variation in daily steps. After controlling for students' demographic characteristics, intention to be physically active and parental support for PA were positively and significantly associated with daily steps ($p<0.01$). For every point increase in intention to be physically active and parental support, an increase of 491 steps and 110 steps/day was found respectively.

Discussion

This study aimed to identify PA correlates among fifth-grade students in HCMC, Vietnam. The results show that socio-demographic influences such as student's gender, parent's age, household monthly income and psychosocial influences such as intentions to be physically active and parental support for PA were significant correlates of PA among fifth-grade students in HCMC, Vietnam. Environmental influences such as perceptions of neighbourhood safety and student's travel mode to school were not associated with physical activity.

The finding that boys were more physically active than girls is consistent with current literature[8,27–29] and with a previous study among adolescents in HCMC, Vietnam.[30] Possible explanations could be that girls may experience less enjoyment during PE classes[31]; are less likely to participate in organized sports[32]; and receive less peer support[33] and parental support than boys.[20] This suggests that interventions should have general components targeting all students and also specific components for each gender. As the level of PA among girls is much lower than boys, additional efforts are needed to assist girls improve their PA. Strategies may include adding more girl-friendly activities in PE classes, creating gender specific extracurricular programs for girls, and informing parents/staff about the need to provide more support for girls to be active both at school and home.[34]

Another factor that strongly correlated with PA was household income, with students from wealthier families taking more steps. It may be that students from wealthier families can afford the fees and equipment required to participate in sports training or other extra-curricular PA programs. Furthermore, wealthier families may live in larger houses and neighbourhoods with better access to PA equipment and open spaces to play. Household food insecurity may also have an effect as American children in food in-secure households did less MVPA than those from food secure ones.[1] Food insecurity is a concern even in urban areas in HCMC.[35] Therefore, future interventions may need to include specific strategies to encourage students from poorer families to participate.

Consistent with findings from a previous review, parental support for PA was positively associated with PA.[11,36] As most reviewed studies were from high income countries, our finding strengthens and expands on current evidence concerning children in urban areas of LMIC in Asia. The finding suggests that improving parental support for PA is crucial and should be targeted in interventions designed to help students be more active and reduce sedentary behaviour. Using some of the meeting time with parents at school to raise awareness about PA may improve parental support for PA.[37] Other strategies including delivering educational materials and information about outdoor activities to family homes may also increase parental support.[38] However, evidence on the effectiveness of these strategies has not been evaluated in the context of Vietnam.

Environmental factors including perceived neighbourhood safety and walking/biking were not significant correlates. Similar results were found among children aged 9–12 years old in Klang district, Malaysia that crime, aesthetics, facilities for walking/biking, and physical/natural obstacles were not associated with PA.[39] Possible explanations may be that: 1) fifth-grade children are less likely to play outside without adult supervision; 2) parents may prefer to drop their children at a sport/PA facility rather than spend time with them in the neighbourhood; and 3) children spend most of their time indoors while attending school, doing homework, watching TV/using electronic devices, or attending private tutoring so little time was spent in the neighbourhood. More studies on environmental influences of PA are needed for students from rural areas where there is less pressure to study as well as access to sport/PA facilities. Additionally, active commuting in urban areas in HCMC may not have a considerable effect on overall PA levels as it only occurs when home and school are in close proximity.

This study is the first study to examine the PA correlates among fifth-grade students in Vietnam. It used pedometers to objectively measure PA in children and has a large representative sample with an acceptable response rate of 61.3%. However, there are some limitations. First, as pedometers can only record steps, activity intensity was not measured. Second, the sample was drawn from public schools in urban areas so the findings would not be generalizable to rural and international/private schools. However, a majority of schools in HCMC are public schools. Third, recall bias may also occur with self-reported data. Fourth, as only one parent was asked to complete the survey, possibly he/she may not be the one providing the highest level of support for PA. Finally, this study was a cross-sectional study so causal relationships between the hypothesised correlates and PA cannot be inferred.

In conclusion, factors associated with PA among fifth-grade students in HCMC include: gender, SES, intention to be physically active, and parental support for PA. These factors need to be considered when designing interventions to promote physical activity in primary school-aged children in HCMC, Vietnam. Future research may investigate: i) the association of neighbourhood safety and PA in rural areas where students have less pressure to study and less access to sport/PA facilities; ii) the effects of environmental features such as proximity and walkability on PA using a geographic information system in rural and urban areas; and iii) explanations for why students from higher income families are more active than their low income counterparts.

Submission statement

This manuscript is not currently submitted elsewhere. None of the manuscript's contents have been previously published in any journal. All authors have read and approved the submitted manuscript.

Authors' contributions

Quyen G. To: Writing - original draft, Data curation, Formal analysis, Conceptualization, Methodology, Project administration, Writing - review & editing. Danielle Gallegos: Writing - original draft, Data curation, Formal analysis, Conceptualization, Methodology, Supervision, Writing - review & editing. Dung V. Do: Writing - original draft, Data curation, Formal analysis, Project administration, Writing - review & editing. Hanh TM. Tran: Writing - original draft, Data curation, Formal analysis, Project administration, Writing - review & editing. Kien G. To: Writing - original draft, Data curation, Formal analysis, Project administration, Writing - review & editing. Lee Wharton: Writing - original draft, Data curation, Formal analysis, Conceptualization, Methodology, Supervision, Writing - review & editing. Stewart G. Trost: Writing - original draft, Data curation, Formal analysis, Conceptualization, Methodology, Supervision, Writing -

review & editing.

Conflict of interest

All authors declare no competing interests. The study received no funding.

Acknowledgement

The authors thank the Department of Education and Training in Ho Chi Minh city, Vietnam, the schools, parents, and students for participating in this research; and the research assistants from Faculty of Public Health, University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam for their assistance and support during the fieldwork.

References

1. To QG, Frongillo EA, Gallegos D, Moore JB. Household food insecurity is associated with less physical activity among children and adults in the U.S. population. *J Nutr*. 2014;144:1797–1802.
2. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Activ*. 2010;7:40.
3. Tremblay MS, Barnes JD, González SA, et al. Global matrix 2.0: report card grades on the physical activity of children and youth comparing 38 countries. *J Phys Activ Health*. 2016;13:S343–S366.
4. Guthold R, Cowan MJ, Autenrieth CS, Kann L, Riley LM. Physical activity and sedentary behavior among schoolchildren: a 34-country comparison. *J Pediatr*. 2010;157:43–49.
5. To QG, Gallegos D, Do DV, et al. The level and pattern of physical activity among fifth-grade students in Ho Chi Minh City. *Vietnam. Public Health*. 2018;160:18–25.
6. To QG, Wharton L, Gallegos D, et al. School-based physical education: physical activity and implementation barriers in Vietnamese elementary schools. *Eur Phys Educ Rev*; 2019 (In press) https://doi.org/10.1177/1356336X19878746.
7. Sallis JF, Cervero R, Ascher W, Henderson K, Kraft M, Kerr J. An ecological approach to creating active living communities. *Annu Rev Publ Health*. 2006;27:297–322.
8. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc*. 2000;32:963–975.
9. He G, Huang WY, Wong SH. Physical activity research in Hong Kong from 1987 to 2012: evidence on children and adolescents. *Asia Pac J Publ Health*. 2014;26:560–574.
10. Davison KK, Lawson CT. Do attributes in the physical environment influence children's physical activity? A review of the literature. *Int J Behav Nutr Phys Activ*. 2006;3:19–36.
11. Trost SG, Loprinzi PD. Parental influences on physical activity behavior in children and adolescents: a brief review. *Am J Lifestyle Med*. 2011;5:171–181.
12. Yao CA, Rhodes RE. Parental correlates in child and adolescent physical activity: a meta-analysis. *Int J Behav Nutr Phys Activ*. 2015;12:10–48.
13. Nugent R. Chronic diseases in developing countries. *Ann N Y Acad Sci*. 2008;1136:70–79.
14. Ministry of Education and Training. *Ban Hanh Quy Dinh Ve Tieu Chuan Danh, Cong Nhan Truong Tieu Hoc Dat Muc Chat Luong Toi Thieu, Truong Tieu Hoc Dat Chuan Quoc Gia*; 2012 [09/04/2017]; Available from: http://thuvienphapluat.vn/van-ban/Giao-duc/Thong-tu-59-2012-TT-BGDDT-cong-nhan-truong-tieu-hoc-dat-chuan-quoc-gia-163114.aspx.
15. Department of Statistics. Statistics of Ho Chi Minh City. Ho Chi Minh City, Vietnam: Department of Statistics2004.
16. World Health Organization. *Physical Status: The Use of and Interpretation of Anthropometry, Report of a WHO Expert Committee*; 1995 [07/08/2017]; Available from: http://apps.who.int/iris/bitstream/10665/37003/1/WHO_TRS_854.pdf.
17. Onis Md, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bull World Health Organ*. 2007;85:660–667.
18. Rowe DA, Mahar MT, Raedeke TD, Lore J. Measuring physical activity in children with pedometers: reliability, reactivity, and replacement of missing data. *Pediatr Exerc Sci*. 2004;16:343–354.
19. Saunders RP, Pate RR, Felton G, et al. Development of questionnaires to measure psychosocial influences on children's physical activity. *Prev Med*. 1997;26:241–247.
20. Trost SG, Sallis JF, Pate RR, Freedson PS, Taylor WC, Dowda M. Evaluating a model of parental influence on youth physical activity. *Am J Prev Med*. 2003;25:277–282.
21. Carver A, Timperio A, Crawford D. Perceptions of neighborhood safety and physical activity among youth: the CLAN study. *J Phys Activ Health*. 2008;5:430–444.
22. Evenson KR, Neelon B, Ball SC, Vaughn A, Ward DS. Validity and reliability of a school travel survey. *J Phys Activ Health*. 2008;5(Suppl 1):S1–S15.
23. To QG, Gallegos D, Do DV, et al. Psychometric properties of questionnaires to measure social ecological influences in Vietnamese children. *Sport Med Health Sci*. 2019;1(1):40–43.
24. Hinton PR, McMurray I, Brownlow C. *SPSS Explained*. New York, USA: Routledge; 2014.
25. Lohr S. *Sampling: Design and Analysis*. Boston, USA: Cengage Learning; 2009.
26. Kramer M. *R 2 Statistics for Mixed Models*. 2005.
27. Van der Horst K, Paw M, Twisk JW, Van Mechelen W. A brief review on correlates of physical activity and sedentariness in youth. *Med Sci Sports Exerc*. 2007;39:1241–1250.
28. Trost SG, Pate RR, Sallis JF, et al. Age and gender differences in objectively measured physical activity in youth. *Med Sci Sports Exerc*. 2002;34:350–355.
29. Fein AJ, Plotnikoff RC, Wild TC, Spence JC. Perceived environment and physical activity in youth. *Int J Behav Med*. 2004;11:135–142.
30. Trang N, Hong TK, Dibley MJ, Sibbritt DW. Factors associated with physical inactivity in adolescents in Ho Chi Minh City, Vietnam. *Med Sci Sports Exerc*. 2009;41:1374–1383.
31. Cairney J, Kwan MY, Velduizen S, Hay J, Bray SR, Faught BE. Gender, perceived competence and the enjoyment of physical education in children: a longitudinal examination. *Int J Behav Nutr Phys Activ*. 2012;9:26–34.
32. Vella SA, Cliff DP, Okely AD. Socio-ecological predictors of participation and dropout in organised sports during childhood. *Int J Behav Nutr Phys Activ*. 2014;11:62–72.
33. Edwardson CL, Gorely T, Pearson N, Atkin A. Sources of activity-related social support and adolescents' objectively measured after-school and weekend physical activity: gender and age differences. *J Phys Activ Health*. 2013;10:1153–1158.
34. Camacho-Miñano MJ, LaVoi NM, Barr-Anderson DJ. Interventions to promote physical activity among young and adolescent girls: a systematic review. *Health Educ Res*. 2011;26:1025–1049.
35. Vuong TN, Gallegos D, Ramsey R. Household food insecurity, diet, and weight status in a disadvantaged district of Ho Chi Minh City, Vietnam: a cross-sectional study. *BMC Publ Health*. 2015;15:232–242.
36. Lee KS, Loprinzi PD, Trost SG. Determinants of physical activity in Singaporean adolescents. *Int J Behav Med*. 2010;17:279–286.
37. Haerens L, De Bourdeaudhuij I, Maes L, Cardon G, Deforche B. School-based randomized controlled trial of a physical activity intervention among adolescents. *J Adolesc Health*. 2007;40:258–265.
38. Brown HE, Atkin AJ, Panter J, Wong G, Chinapaw MJM, van Sluijs EMF. Family-based interventions to increase physical activity in children: a systematic review, meta-analysis and realist synthesis. *Obes Rev*. 2016;17:345–360.
39. Tung SEH, Ng XH, Chin YS, Mohd Taib MN. Associations between parents' perception of neighbourhood environments and safety with physical activity of primary school children in Klang, Selangor, Malaysia. *Child Care Health Dev*. 2016;42:478–485.